Pilots with mobile game 'ELENA goes shopping'

Background and objectives of the mobile game

Within the ELENA mobile game pilot we explored the functionality that a mobile phone offers to familiarize children (6-8 years) with a neighbouring, unfamiliar language (German) in a 'real world context', in an interactive, playful and independent way, outside the classroom. Another objective was to involve third parties (like parents, grandparents) in the language learning process of the children.

In order to do so, a mobile game was developed that aimed to connect to children's perception of the world and their immediate (geographical) living environment and to the ELENA online learning material. In terms of language learning, the games objectives were to:

- Stimulate young children's interest in foreign languages
- Familiarize them with the sounds and pronunciation of a neighbouring language
- Learn, repeat and practice vocabulary , by listening, understanding and speaking/imitating the language

Development and description of the mobile game

Development process

Before the first version of the game scenario was designed, some literature on early language learning, play theory and mobile technology for learning was reviewed [1]. Based on that, the requirements for the game scenario were derived and implemented in a first version of the game on paper, later implemented by means of the tool ARLearn (www.ou.nl/arlearn). ARLearn [2] is an open source tool suite for educators and learners supporting mobile serious games. It enables the creation and management of game scenarios and runs (game instantiations with real time communication).

We first developed the scenario on paper, elaborating the script text until the level of dialogues between ELENA and the child. Then we talked the scenario through, to see whether any developmental changes to the ARLearn tool sh/could be realized to implement the scenario. As the target group is young children we decide to build in support for non textual messages into ARLearn. Graphical single/multiple choice messages were implemented. Rather then offering kids during the game the option to select the word "grandfather" as an answer to a question, the kids can now instead select a picture representing the grandfather.

Several versions of the game were developed, tested and improved based on the feedback of different actors, in a continuous and incremental development cycle, as follows:

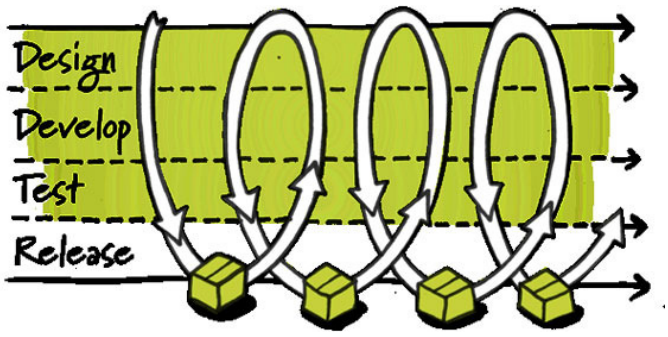


Figure: Cyclic development process[1]

Mobile game	Evaluated by
Version 0 (paper scenario)	Educational designer and IT-expert
Version 1 (ARLearn implementation)	Language Learning Experts
Version 2 (ARLearn implementation)	Children and accompanying adults
Version 3 (ARLearn implementation)	Children and accompanying adults

Description of the game

The table below summarizes the design decisions taken for the development of the **first version** of the game in ARLearn. The mobile game connects to the theme 6 'Elena goes shopping' that is introduced in the ELENA online learning material. The game scenario directs and guides children and their (grand)parents to do the shopping that is needed for baking pancakes in a local supermarket.

Design aspect	Decision and description	Theoretical and practical background
Target group:	Children aged 4-6	At this age children still learn by immersion and in a playful way and are not yet hindered by formal rules & structures of a language. Falls within age range of the ELENA project (4-8 yrs).
Theme:	Shopping for baking pancakes	Connects to children's near experiences and tendency to role-play, imagine and pretend, as well as storytelling-aspect of internal motivation to play. Also connects to theme 6 'Shopping' of ELENA online lesson material.
Context:	Home and supermarket. Connects both contexts by means of a shopping list.	Relates to environment of the child, a real-world context that they know. Taps into internal motivation of child to learn different words for the same object.
Location:	Any supermarket	Activities should not be tied to a specific supermarket, but 'playable' in any supermarket.
Learning objectives:	To familiarize children with sounds and pronunciation; to learn, repeat and practice vocabulary; to raise interest in languages	Connects to natural language learning tendency of young children. Importance of training the ear, to become familiar with the sound system

[1] http://www.insider-trends.com/future-of-retairetail-trends-thoughtworks-agile-retail-trends

Content:	Target words of theme 1 to 6. Focus on listening, understanding and speaking the language	Connects to learning objectives, repetition of previously learned words, using them in context and increasing 'out-of-school' exposure to the words.
Learning activities:	No collaborative activities. Activities such as: say and record (your name), sing (and record) in alternative ways (fast, slow), listen to a/your recording, search and find/collect and take a picture, show me (by taking a picture), choose (and listen to the alternatives), taste, smell, count. Enthusiastic feedback after an action.	Connects to learning objectives, facilitates connection and interaction with the environment, multi-sensory approach and feedback (by listening to own productions), takes advantage of the affordances of a mobile (e.g. offering additional information/multi-media material on a location), learning by exploration, (word)play, imitation and repetition. No collaborative activities as this needs organisation in advance, which is not possible in an informal setting. Pupils and adults should be enabled to play the game whenever they like, combining it with doing their shopping in their own supermarket. Activities don't promote running, shouting etc., to avoid annoyance in the supermarket.
Control: children	Child (with some help) can go through the scenario independently/at their own pace	Children explore social, material and imaginary worlds and their relationship themselves, on their own
Assistance/ guidance:	ELENA (a girl aged 7) guides and instructs children's activities in context and (grand)parents/adults assist	ELENA connects to children's own characteristics and helps to 'tell a story'. Foster involvement of all parties when learning a language, also (grand)parents
Instructional language	In mother tongue, short informally formulated instructions (in a 'buddy' type of way), repeated in the target language.	Show relation of the sound system between mother tongue and target language. Avoid misunderstanding of the instruction.
Time needed:	Max. 60 min (incl. travel time)	Limited concentration and attention-span of children. Increase likeliness of playing the scenario in a supermarket
User interface:	Predominantly use graphics and audio	Supports learning objectives as well as learning multi-sensory. Children cannot read yet.
Device and access:	Playable on any android phone and download via play-store	Supports a large group of phone users. Supports open source development and distribution.

Children receive the first activity of the mobile game on their mobile phone and once they completed this activity, they receive the next activity. After completing activities, they receive a puzzle piece, which in the end forms a picture of Elena baking pancakes with her father. This marks the end of the game.

Evaluation of the mobile game

Version 1 - Expert review

Context description and participants

After the design and implementation of the 1st 'playable' version of the mobile game in ARLearn, 8 experts from the ELENA project (representing (foreign) language learning expertise as well as learning-and instructional and graphical design expertise) evaluated this version on its feasibility for reaching the objectives as well as on game scenario implementation issues. They individually played the game on mobile phones that were handed out during the session.

Evaluation instruments and method

Before playing the game the objectives of the game were presented shortly. Then participants played the game. After playing the game they filled a questionnaire individually (see Attachment A). The experiences with playing the game were subsequently discussed in a focus group session.

Results

Feasibility

The majority turned out to be rather positive towards the feasibility of the mobile game scenario for its objectives. In the table below we present a selection of the results related to the key objectives of the scenario. Percentages are rounded upwards, some items lack a response from all experts, thus the total of each item does not always sum up to 100%.

	1 Strongly Disagree	2	3	4	5 Strongly Agree
Evaluation of objectives					
I think that the scenario makes children aware of the existence of other languages than their mother tongue	-	13%	13%	38%	38%
I think that the scenario raises children's interest in another language than their mother tongue	-	13%	38%	38%	13%
I think that children will like/have fun with the scenario	13%	-	-	63%	25%
I think that the scenario helps children to learn new vocabulary of a foreign language	-	13%	38%	25%	25%
I think that the scenario helps children to repeat/practice learned vocabulary of a foreign language	-	13%	38%	38%	13%
I think that the scenario helps children to learn the significance of vocabulary of a foreign language in a real-world context	-	-	50%	25%	25%

I think that the scenario helps children to remember vocabulary of a foreign language better by learning it in a real-world context	-	-	38%	25%	38%
I think that the scenario helps to involve (grand)parents with the early language learning of their (grand)children	13%	-	25%	50%	13%
I think the scenario will make early language learning more interesting for children	-	13%	-	63%	13%

Usability, user experiences and proposed changes

	1 Strongly Disagree	**2**	**3**	**4**	**5 Strongly Agree**
Evaluation of usability					
I think that children can independently (without support) find their way through this scenario	-	38%	50%	-	-
I think that children can, together with a (grand)parent, find their way through this scenario	-	-	-	88%	13%
I found the scenario unnecessarily complex for children.	25%	50%	13%	13%	-
I would imagine that most children would learn to use this system very quickly.	-	-	13%	50%	25%
I think children will feel very confident using the system.	-	-	25%	50%	25%

One of the results of this evaluation was a different perspective on the **age of the target group**. Although the mobile game was originally targeted at the age range of 4 to 6 years old, the mean age indicated by the experts was 7 years. In the discussion afterwards, it became clear that the advice was to focus on the age range of 6-8 yrs. For this group, it was suggested that the game instructions could also be **directly offered in the target language (German)** and then translated in the mother tongue (Dutch). The mean estimation of the **duration of the game**, without travel time to go to a supermarket, was 34 minutes. This length was indicated as just right, however it was stressed that the duration of the next version of the mobile game should not take (much) more time and also that the audio-instruction fragments should be as short as possible. Regarding **the interface** it was advised to include some additional instruction about how to operate the mobile phone and to make the interaction with menu/buttons etc. more graphically oriented. Another advice from this evaluation was that **all the activities had to be related to and focused on the 'shopping and baking pancakes' theme** and that activities should not deviate from this theme. In the first version of the scenario also activities like 'singing' and 'counting cars/traffic lights' etc. during travel time to the supermarket were included, next

to smelling and tasting other products in the supermarket. These activities were either removed or replaced by other activities in the next version of the mobile game.

Version 2 - First pilot: Supermarket visitors

Context description and participants

The second version of the game was played with some target group members (kids, aged between 6 and 8, and accompanying adults) in a local supermarket in Heerlen. The supermarket manager agreed to participate in the pilot in advance and even offered all children something to drink and a sweet . The supermarket location was elaborately tested on the availability of a working mobile data network before the pilot. One and half week before the game was offered some advertisement was hung at the entrance of the store, so that customers were informed about this activity. On the pilot day we offered the game to customers within our target group at the entrance of the supermarket. All children who wanted to participate received a mobile phone (to lend) with ear plugs, to diminish 'supermarket noises'. A Quick Response (QR)-code was used to link a participant to the mobile game. This code consists of an array of black and white squares, typically used for storing URLs or other information for reading by the camera on a smartphone. ARLearn supports a QR-code mechanism to start games. Before the pilot, 50 QR-codes were generated that each represent an "anonymous" user. By scanning this QR code with ARLearn, a game is initialized for a new participant. A short instruction on the use of the specific mobile phone was given and then they went to play the game. They were told that when they encountered any problems with the mobile game, they could either ask the accompanying adult or come back to the desk at the supermarket entrance. Accompanying adults signed a twofold agreement for 1) using the gathered data for research /reporting purposes and 2) to allow the use of photo's/video's made during the pilot for use in media for dissemination purposes. 8 children and 7 adults participated in the pilot. After playing the game and participating in the evaluation the children received a small gift.

Evaluation instruments and method

This evaluation focused on users' perception of and user experiences with the game. The user perceptions and experiences were gathered by means of semi-structured interviews with the children (Attachment B) as well as their accompanying adults ((grand)parents, other family/friends) (Attachment C). All interviews were audio recorded and transcribed. From these interviews relevant comments with feedback on their perception of the mobile game as well as its usability were distilled. Observations of 'game play' in the supermarket were made, but not pre-structured in advance.

Results

Impressions

Some images are included to provide an impression of the 1st pilot with the 2nd version of the ELENA mobile game (revised after the expert review).

2 of the 3 posters to inform supermarket customers about the pilot in advance

'Reception desk' at supermarket entrance

'Checking in' the game with a QR-code

Our first participants

One earplug for two
(the municipality Heerlen also had interest in the project and therefore recorded the pilot)

They are doing fine!

Other interested parties

Small gift for participants

Usability , user experiences and proposed changes

From the pilot we learned that all children in the target group (6 till 8 years) could play the game independently, almost without help of the accompanying adult or from the ELENA project members. Some help was given, e.g. to find the different products in the supermarket, or with finding the 'record' button. Although the instruction was now given in the target language (German) mainly, with some additional translations of key instruction sentences in Dutch, children could predominately play the game themselves. Most of them already had some experience with the use of a mobile phone. The children who didn't have this experience (as indicated by the accompanying adult) could anyhow play the game. Younger children that also wanted to participate came back in vain after having tried the game. This indicated that our original age range of 4-6 indeed was too young (as the experts also indicated), and that our current target group (6-8) seems to be fine. An issue was the mobile data connection: this connection was not stable on every spot within the supermarket, sometimes hindering the loading of a subsequent game activity. However, this was solved when participants walked to another part of the supermarket. The earplugs indeed helped with preventing distortion of 'supermarket noises' (music, announcements, bleeping of cash desks etc.), however sometimes the earplugs didn't fit well in the ears of children and then the background noise became an issue.

The majority of children and adults found the game fun and educative. All interviewed adults, accompanying a child, would offer a comparable game for learning languages or other things within a specific context, although the fact that the game was offered for free also played a role in this positive evaluation. Most adults didn't bought an educative app before, some of them did download freely available apps. All interviewed children would also like to play a comparable game on a mobile phone on a specific location (location-based/location- related) to learn about this environment.

Below some example cites from the interviews from both groups:

Children	**Adults**
"Very nice! You are actually shopping, but then in the form of a game"	"I think it is nice to learn a child words in this way, to keep them active and engaged with things they have to learn anyhow"
"A lot of children would like to have a mobile phone and now you are active instead of sitting always behind books"	"I am not an advocate of a mobile phone, so I would prefer to do it on something different than a mobile."
"I understood everything"; "I liked the game"	**But on a certain spot and in a way that they can do something themselves?**
"It's, nice because now I can talk to someone in a foreign country whenever I am lost"	"That is not a problem to me!!"
"I like to do something instead of standing somewhere [waiting]"	**"What would you propose, for example?"** "A tablet is actually the same as a mobile phone. Then it becomes complicated. With shopping you can't carry such a large device… Than the mobile phone is quite handy, actually"

Although the ARLearn infrastructure already provided means to cache game content, such as audio and video, messages are expressed using HTML. Images that were embedded in this HTML-content were loaded as they were opened. At the supermarket, in the absence of Internet, these images did not load. As a result, the ARLearn toolkit was extended with functionality to support offline caching of images, embedded in a HTML message. The game than still needs to be 'built' per activity when playing the game (as the completely downloaded game will not be visible at once to the user), but the game activities will already be available 'behind the scene', preventing problems with the game related to the mobile data connection at a location. It should also become possible to download a game without the need of a QR-code. The duration of the game was right, as all participants played the game till the end and didn't find it boring. Also the content of the game was evaluated positive, with kids specifically mentioning the singing activities and puzzle pieces as fun. Furthermore, the instruction starting with the target language instead of the mother tongue didn't cause any problems for children in the target age group (6-8 years) while playing the game.

Version 3 – Second pilot: Scouts and supervisors

Context description and participants

To evaluate the mobile game with a larger group of children in the target group age we organized a pilot with a Scouting group (Bevers, 25 children), their supervisors and assisting parents (7 adults in total). In this pilot we were interested in users' game perceptions, the usability of the game and in addition in the language learning effects. We organized this pilot in close collaboration with the scouting supervisors, for which we had several joint meetings (to inform about the Elena project and material, the game, the objectives of the pilot, how to organize it practically etc.). All parents were asked in advance to agree with the use of the collected data for research purposes and also with the use of photo/video material for Elena reporting and dissemination purposes. All parents agreed. The supermarket manager agreed to participate in the pilot in advance and also offered all children something to drink and a sweet, in addition to the small gift (a scouting badge and a contribution to pancakes ingredients) offered by the Elena project. After playing the game and gathering all ingredients for making pancakes the children went to their scouting building to bake and eat pancakes. This version of the game allowed a complete download of all game activities, without the activities being visible for the user directly, to prevent download problems while playing the game.

Evaluation instruments and method

The Elena project members received the children and their supervisors in small groups at the entrance of the supermarket. The children received a mobile phone with the game locally installed in advance on it. Both children and supervisors were instructed shortly, the children did a short interview (Attachment D, audio-recorded) and then they went into the supermarket to play the game and gather the ingredients for making pancakes. Afterwards children did another interview (Attachment E, audio-recorded) and the accompanying parents filled a questionnaire (Attachment F). This questionnaire contained 14 open questions mainly about the game, and 5-point Likert-scale questions: the System Usability Scale (SUS, Dutch translation) and 7 questions related to the games' intentions.

Results

Impressions

Some images are included to provide an impression of the 2nd pilot with the 3rd version of the ELENA mobile game (revised after the first pilot).

Interviewing a child before the game

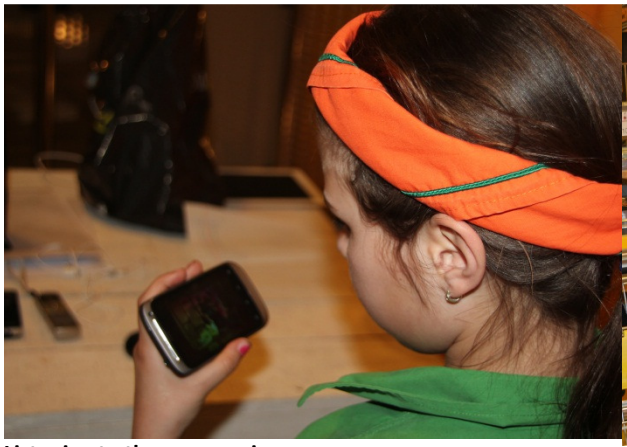
Some instruction in advance

Playing the game

Gathering ingredients

Can I have a go too?

The results of the game: pancake ingredients



Listening to the song again

Paying after playing

Gathering experiences

Gathering even more experiences..

Filling the questionnaire

Baking pancakes!

Enjoying the reward of all efforts

Mmmmm…

The Elena badge

We also earned the badge!

Usability , user experiences and proposed changes

Accompanying adults' perspective

The answers on the open questions in the questionnaire showed that the accompanying adults (parents and scouts supervisors) found the game suitable for the higher end of the intended age range (7 a 8 years). They find it fun and educative. Adults particularly value being active, but it was also mentioned that the game helps children to remember and recall things, to learn shopping and become independency, next to the language learning aspect. Also, in this pilot they indicated the importance of the app being free, as not everyone can afford to buy educational apps (also buying a smart phone can be problematic. They noted that the interaction could be improved regarding some buttons, they especially experienced some faults with making photos and sometimes with recording audio. Also they noted that going 'back and forth' between the list and specific activities sometimes was confusing and hindered the orientation in the game (which activity should we do now?; where are we in now?). The dread of the earplugs sometimes touched the screen so that you would go to another activity without intending and then it was confusing to find the way back to the right activity again. As the earplugs sometimes fell off the children's' ears, one of the parents suggested to use headphones instead (unfortunately not available for this pilot setting). The adults also noticed that some clients of the supermarket reacted a bit irritated, because of the large group of kids playing the game in the supermarket while they were doing their shopping. However, this is prevented when the kids play the game individually, accompanied by their (grand)parents or other parties, as this is the games purpose.

The overall evaluation of the game from the answers of the questionnaire showed that the game was overall valued positively (most scores around 3, but some questions with more variance than others, showing that on some issues adults differed more in opinion than others). We highlight some interesting results (in terms of a stronger/weaker judgment and in terms of the variance), in the table below. We here show the results for questions with a mean higher than 3 (= agree), or lower than 2 (moderately disagree). Looking at these results we can see that most adults consistently agreed that the functions of the game were well integrated for children. They also agreed, without many differences within the group of adults that children can learn the basis of another language independently (without help) with the game, that it motivates children to learn another language and that it makes early language learning more interesting for children. They generally didn't perceive the game as inconsistent for children. Some of the results seem contradictory at first sight. However, when looking at the answers to the open questions they can be interpreted. For example adults generally seem to agree (with some variance within the group) that the game is unnecessarily complex, but at the same time imagine that most children would learn to use the game very quickly. As complexity can refer to different aspects of the game, e.g. using the devices in combination with the earplugs, navigating in the game etc. as was mentioned in the open answers of the game, these aspects can be improved, but the game itself still is learnable for children.

Scale:

1 = strongly disagree

5 = strongly agree

Question	Mean	Variance
I found the game unnecessarily complex for children.	3,14	1,14
I found the various functions in this game well integrated for children.	3,43	,29
I thought that for children there was too much inconsistency in this game.	1,71	,91
I would imagine that most children would learn to use the game very quickly.	3,57	1,95
Children felt very confident using the game	3,29	1,57
The game makes children aware of the existence of other languages than their mother tongue	3,14	1,48
The game helps children to learn new vocabulary of a foreign language	3,29	1,57
Children can learn the basis of another language independently (without help) with the game	3,14	,48
The game motivates children to learn another language	3,29	,57
The game makes early language learning more interesting for children	3,43	,29

Children's perspective

Most children were at the upper age range for which the app is meant (8 years). Most children didn't have any prerequisite knowledge in German (most couldn't correctly translate the 10 words in the list), with one exception (translation of 4 words) of a child with German parents. During the 'intake' interview some children wanted to mention the German word, but mentioned exactly the same word in Dutch as a translation.

After playing the game, children mentioned having learnt various things, like: shopping, the location of products in the supermarket, that the German is quite similar with the Dutch language, names of objects in German, some German language, handling a mobile phone, the ingredients of pancakes. The actual increase of retention after playing the game after half an hour (difference between number of words translated before and after the game) of German words was on average between 1 and 2 words. Noticeable, some children couldn't recall words from the 10-word list, but could recall several other German words from the game.

Some children mentioned that they couldn't find the task that they were busy with, after accidently moving to another activity or the phone did something else that they intended to do. They mainly received help from the adults with retrieving the right activity and with finding the right shelve in the supermarket. They also mentioned that they sometimes couldn't hear the instruction of the task, due to earplugs falling out, or other children that were talking.

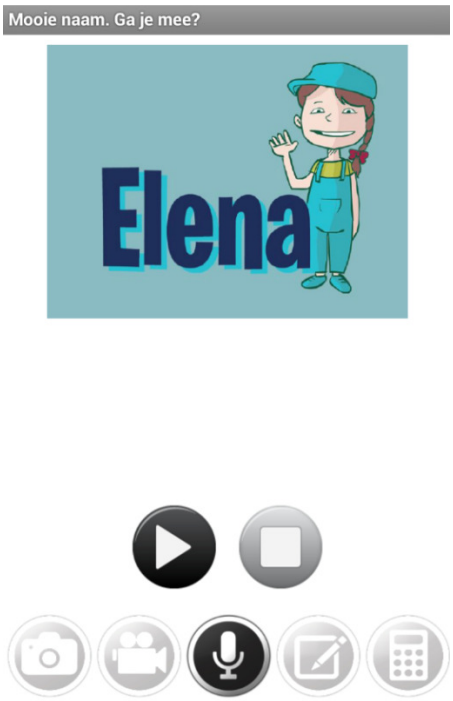
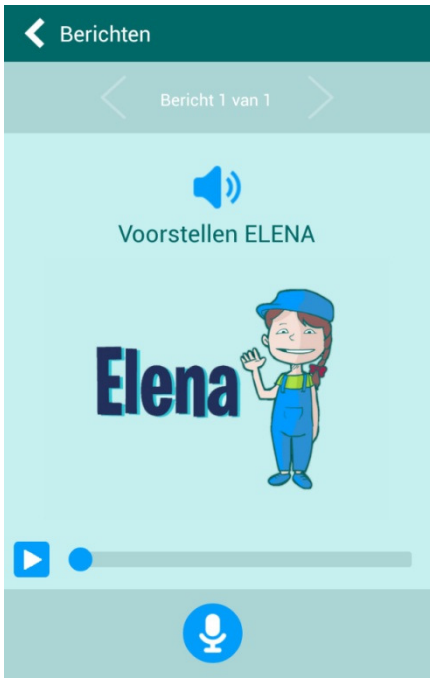
All children participating in the pilot liked to play the game. Highlights were making pictures, the movie with the song and searching for the products in the shelves. The fact that new questions were 'coming in' was also mentioned as fun. They especially liked that they could play the game and shop the ingredients independently, that they could take them out of the shopping shelves themselves. Some of them explicitly mentioned that they liked to learn another language, for various reasons. All

children would like to play more of these type of games, mentioning that it allows them to do things quicker than at school, at their own pace. They also liked that it was differently from what they do in school, as activities in school are almost similar, 'same of the kind' every day. Also the fact that they could move and be outside the classroom in another environment, play themselves and independently ('doing things yourself!) or doing it together with a friend instead of sitting in the classroom, was mentioned as attractive. Doing things instead of sitting and listening was mentioned as making learning less boring. Also, the classroom is visited often and for a change it is nice to learn something somewhere else.

A suggestion for the game was to make a kind of time counter, so that you need to finish the game within a certain time span. Another suggestion was the possibility to create teams yourself, and that you could play against another team, without guidance of adults.

Changes in mobile game 'ELENA goes shopping'

Based on the feedback from this pilot we changed the interaction with the user face, in collaboration with a graphical designer. We made it possible to go back and forth between messages, according to a 'book' metaphor (like turning pages). We also more clearly showed the order of the messages by numbering them. In addition it is still possible to go to the 'list overview', however by using another color for indicating which activity is active, you can distinguish between the other activities. In the following table you find some images that show the changes that were made to the game based on the feedback received during the pilot.

Version used during pilot	**Version developed after pilot**
	

We didn't change the 'team' option, as the objective of the game is that you can play it individually, while adults are doing their shopping. We also didn't change the 'time counter' option, as it would probably increase the chance that children will start running through the supermarket.

Conclusions

Mobile game scenarios potentially offer the possibility to connect 'real-world' objects with their alternative names in another language, help children to become familiar with another language, extend and enhance (by making it more varied) foreign language learning time (e.g. by using 'travel time' and promoting 'out-of-class' activities) and can instruct, guide, motivate and activate children to perform foreign language learning activities, while they are acting themselves independently within an (existing, enhanced or created) environment.

Location of the game

The mobile game 'Elena goes shopping' can be found via the Google play store (https://play.google.com/store/apps/details?id=org.celstec.arlearn2.android.elena) as well as via the Elena project website at http://elena-learning.eu/mobiel.php .